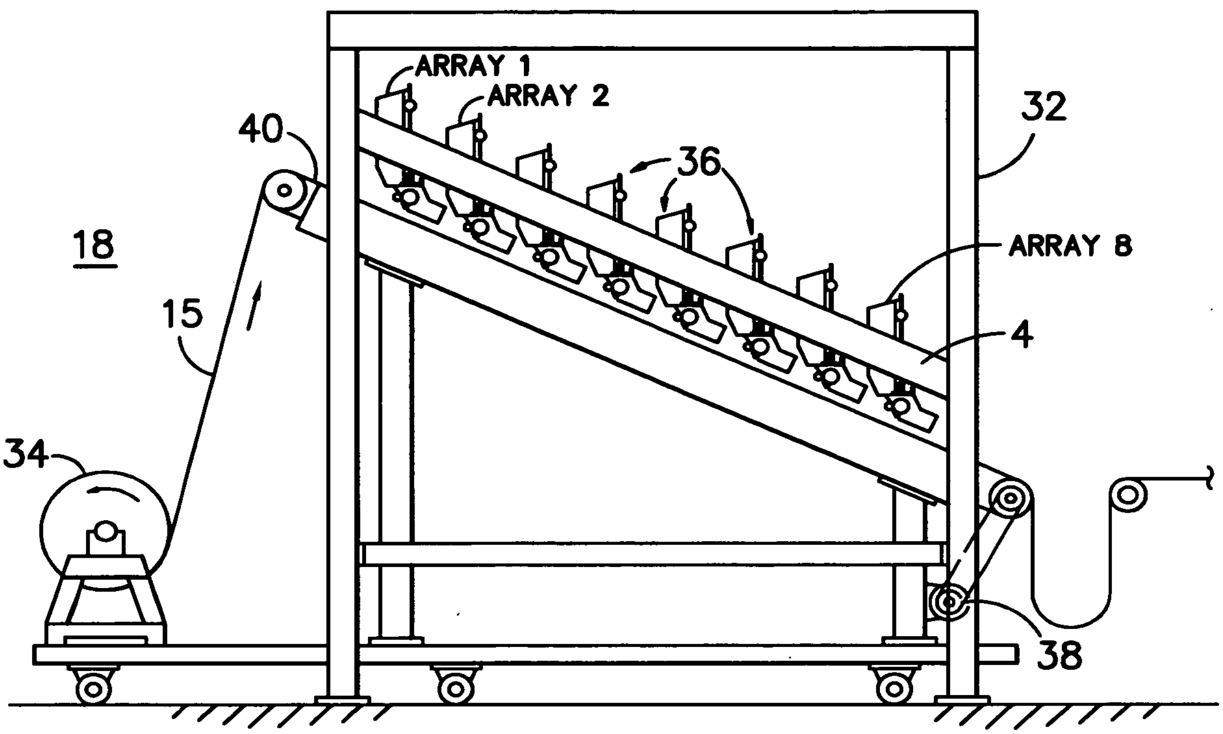


FIG. –1–

09943729.080201

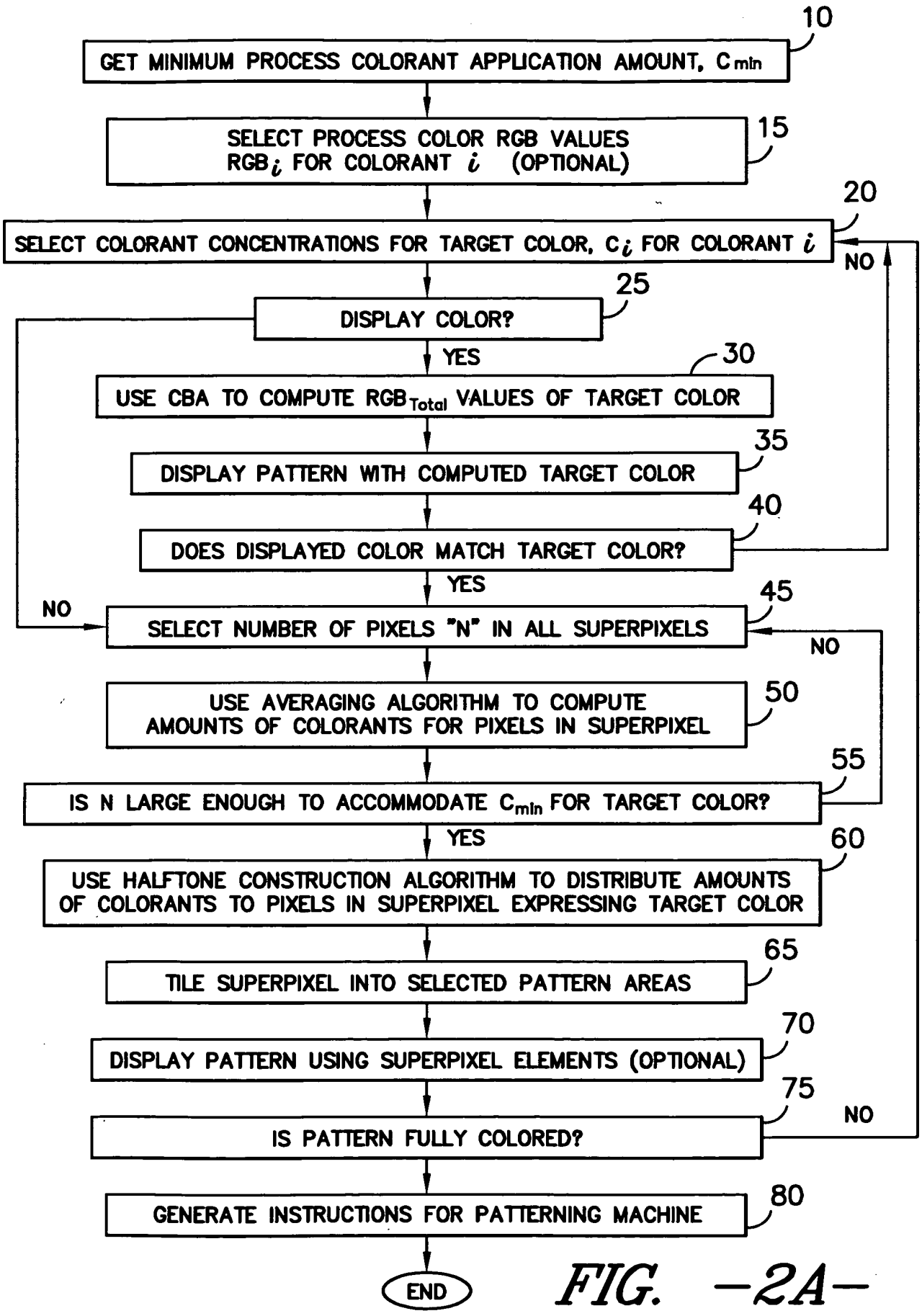


FIG. -2A-

EP 0 823 694 A2

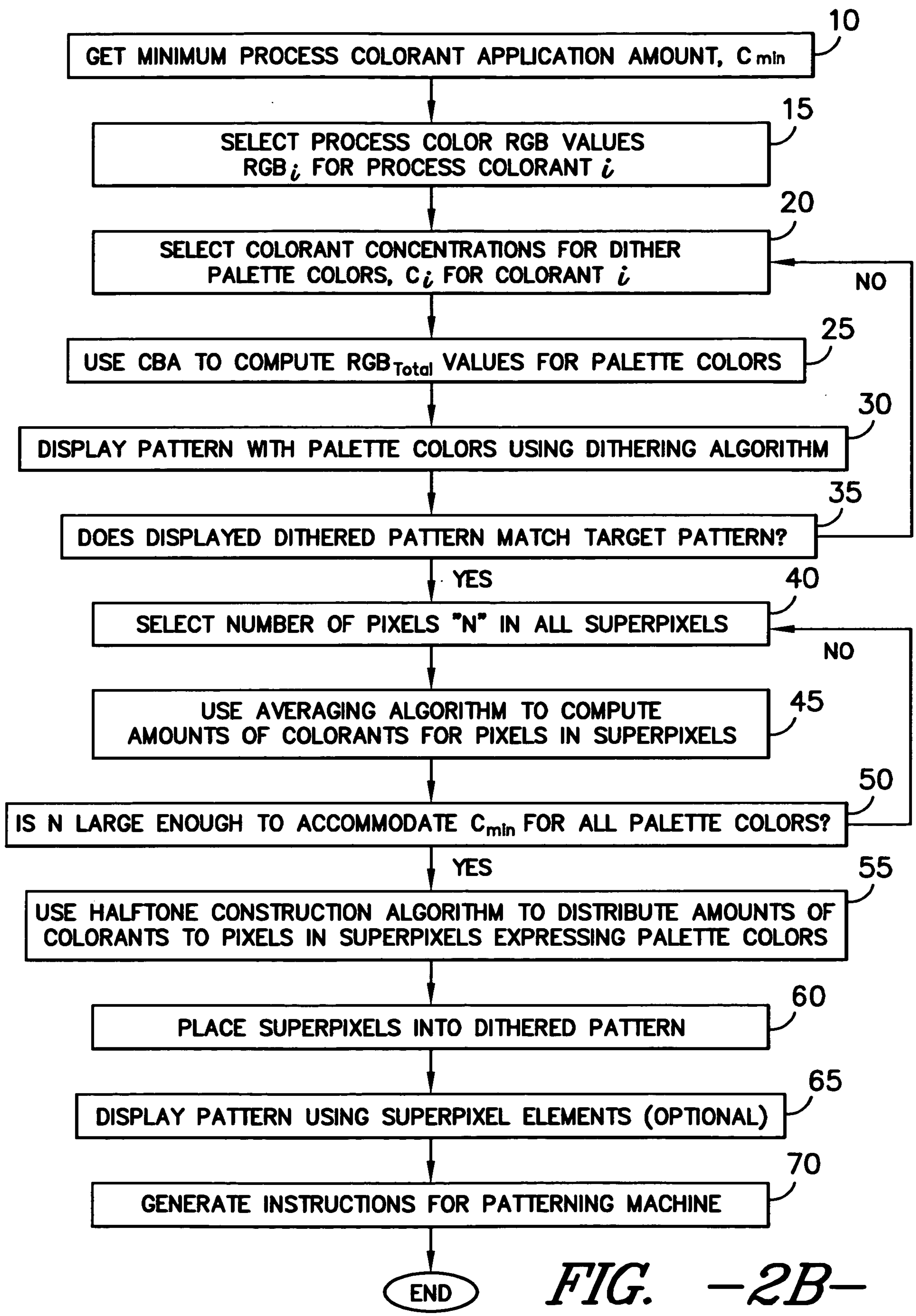


FIG. -2B-

09637429.082201

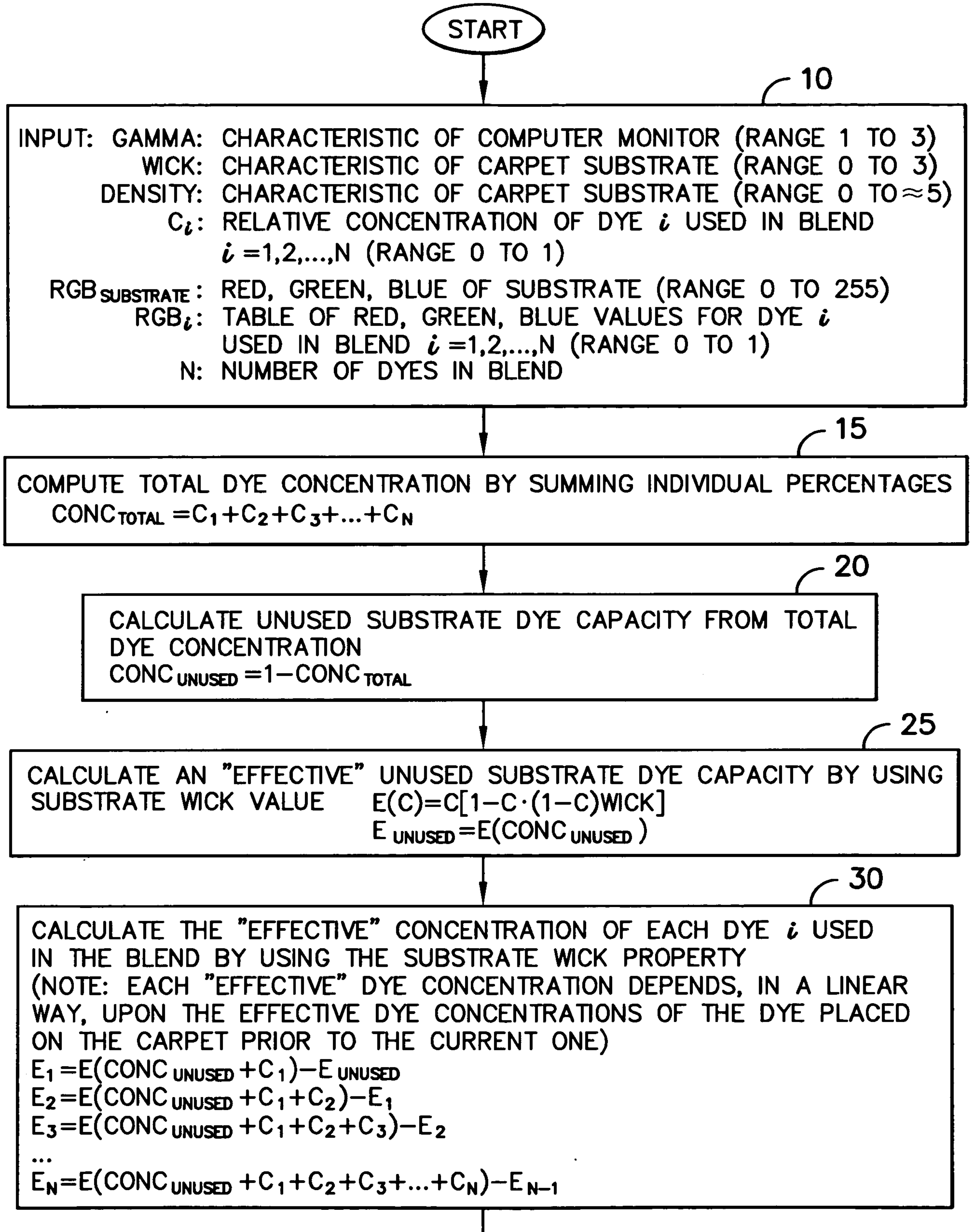

START
10
INPUT: GAMMA: CHARACTERISTIC OF COMPUTER MONITOR (RANGE 1 TO 3)
WICK: CHARACTERISTIC OF CARPET SUBSTRATE (RANGE 0 TO 3)
DENSITY: CHARACTERISTIC OF CARPET SUBSTRATE (RANGE 0 TO ≈5)
C_i: RELATIVE CONCENTRATION OF DYE i USED IN BLEND $i=1,2,\ldots,N$ (RANGE 0 TO 1)
$RGB_{SUBSTRATE}$: RED, GREEN, BLUE OF SUBSTRATE (RANGE 0 TO 255)
RGB_i: TABLE OF RED, GREEN, BLUE VALUES FOR DYE i USED IN BLEND $i=1,2,\ldots,N$ (RANGE 0 TO 1)
N: NUMBER OF DYES IN BLEND
15
COMPUTE TOTAL DYE CONCENTRATION BY SUMMING INDIVIDUAL PERCENTAGES
$CONC_{TOTAL}=C_1+C_2+C_3+\ldots+C_N$
20
CALCULATE UNUSED SUBSTRATE DYE CAPACITY FROM TOTAL DYE CONCENTRATION
$CONC_{UNUSED}=1-CONC_{TOTAL}$
25
CALCULATE AN "EFFECTIVE" UNUSED SUBSTRATE DYE CAPACITY BY USING SUBSTRATE WICK VALUE
$E(C)=C[1-C\cdot(1-C)WICK]$
$E_{UNUSED}=E(CONC_{UNUSED})$
30
CALCULATE THE "EFFECTIVE" CONCENTRATION OF EACH DYE i USED IN THE BLEND BY USING THE SUBSTRATE WICK PROPERTY
(NOTE: EACH "EFFECTIVE" DYE CONCENTRATION DEPENDS, IN A LINEAR WAY, UPON THE EFFECTIVE DYE CONCENTRATIONS OF THE DYE PLACED ON THE CARPET PRIOR TO THE CURRENT ONE)
$E_1=E(CONC_{UNUSED}+C_1)-E_{UNUSED}$
$E_2=E(CONC_{UNUSED}+C_1+C_2)-E_1$
$E_3=E(CONC_{UNUSED}+C_1+C_2+C_3)-E_2$
...
$E_N=E(CONC_{UNUSED}+C_1+C_2+C_3+\ldots+C_N)-E_{N-1}$

FIG. —3A—

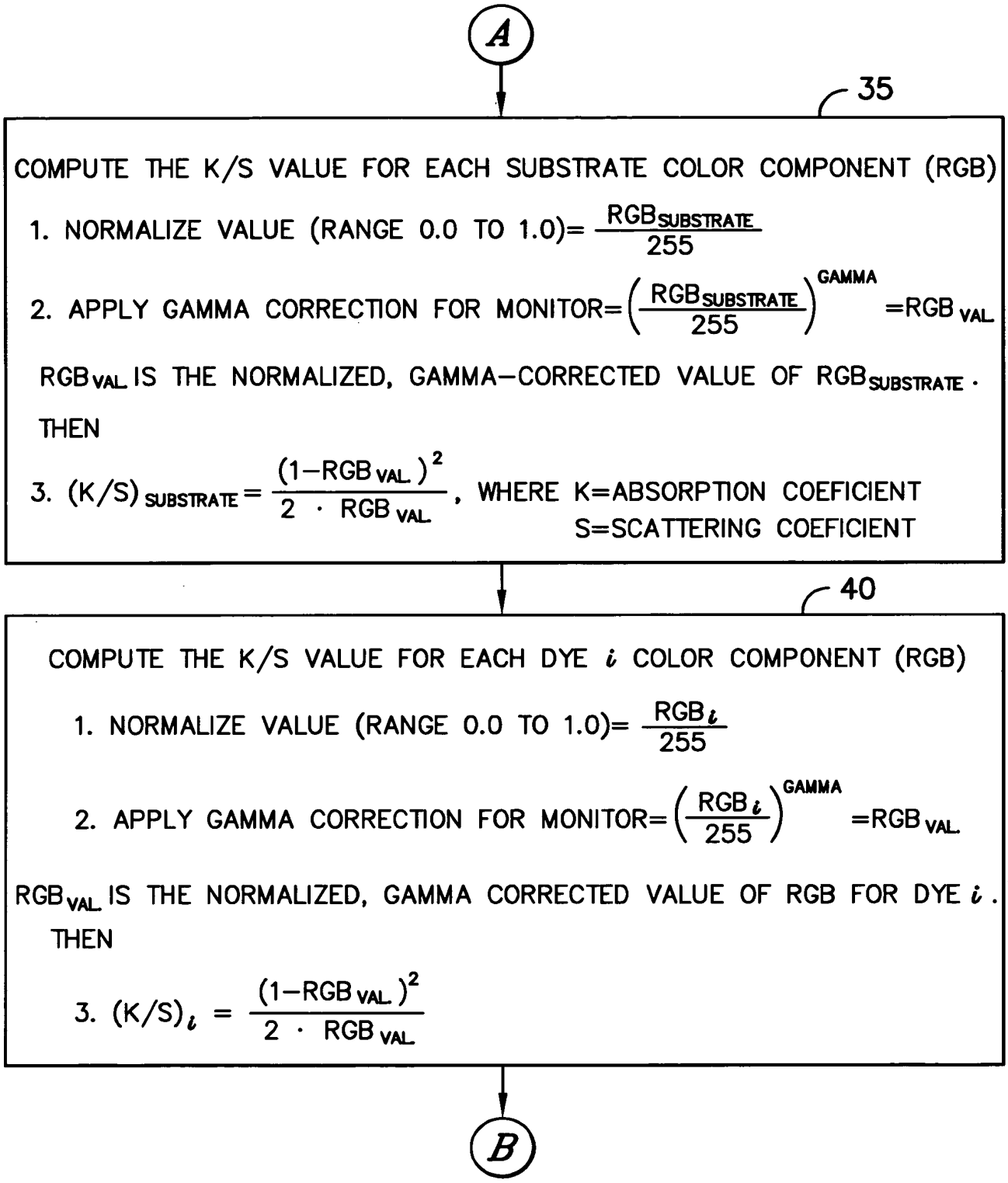

A
35
COMPUTE THE K/S VALUE FOR EACH SUBSTRATE COLOR COMPONENT (RGB)
1. NORMALIZE VALUE (RANGE 0.0 TO 1.0)= $\frac{RGB_{SUBSTRATE}}{255}$
2. APPLY GAMMA CORRECTION FOR MONITOR= $\left(\frac{RGB_{SUBSTRATE}}{255}\right)^{GAMMA}$ =RGB_{VAL}
RGB_{VAL} IS THE NORMALIZED, GAMMA-CORRECTED VALUE OF $RGB_{SUBSTRATE}$.
THEN
3. $(K/S)_{SUBSTRATE} = \frac{(1-RGB_{VAL})^2}{2 \cdot RGB_{VAL}}$, WHERE K=ABSORPTION COEFICIENT
S=SCATTERING COEFICIENT
40
COMPUTE THE K/S VALUE FOR EACH DYE i COLOR COMPONENT (RGB)
1. NORMALIZE VALUE (RANGE 0.0 TO 1.0)= $\frac{RGB_i}{255}$
2. APPLY GAMMA CORRECTION FOR MONITOR= $\left(\frac{RGB_i}{255}\right)^{GAMMA}$ =RGB_{VAL}
RGB_{VAL} IS THE NORMALIZED, GAMMA CORRECTED VALUE OF RGB FOR DYE i.
THEN
3. $(K/S)_i = \frac{(1-RGB_{VAL})^2}{2 \cdot RGB_{VAL}}$
B

FIG. -3B-

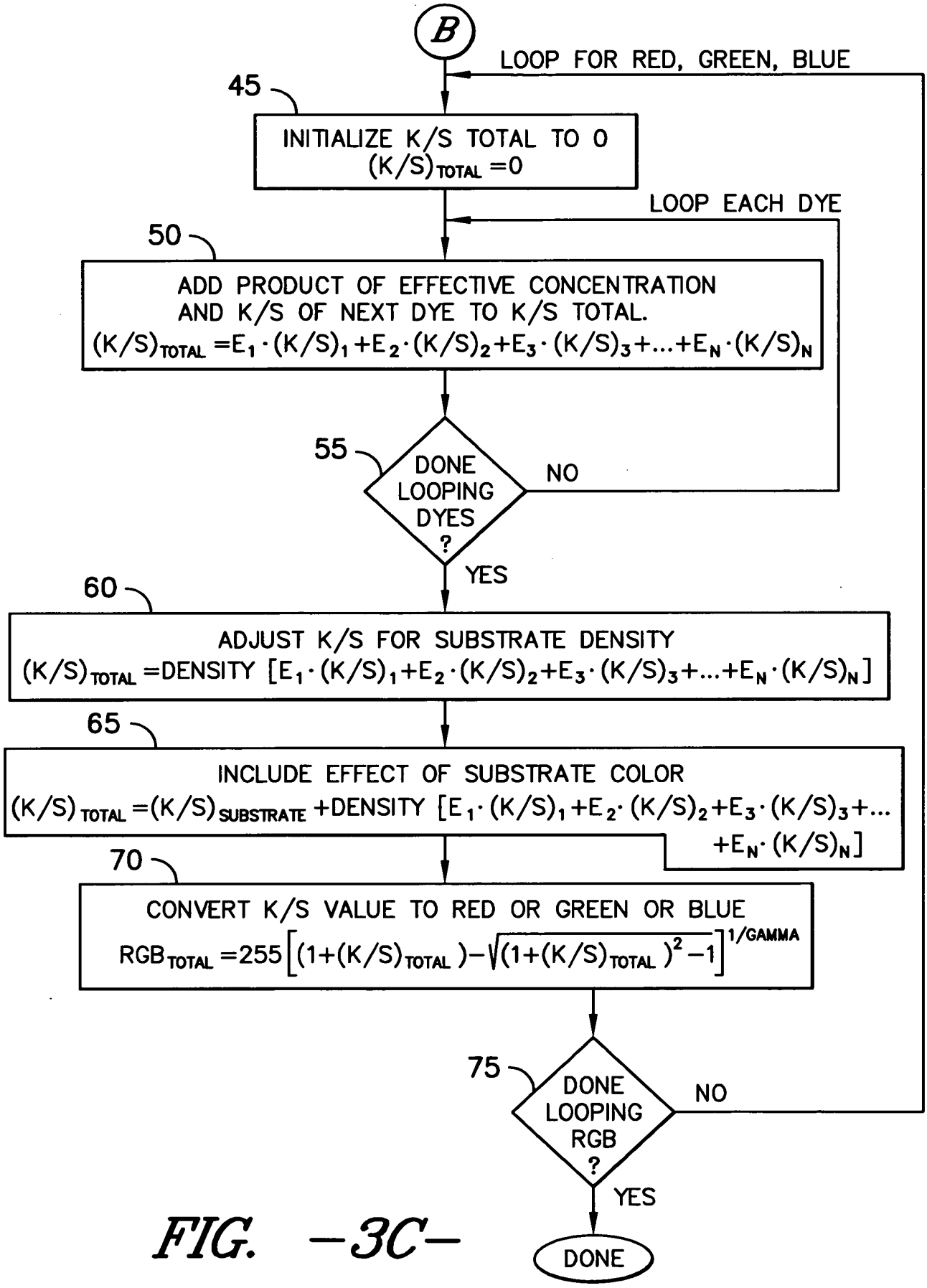

B
LOOP FOR RED, GREEN, BLUE
45
INITIALIZE K/S TOTAL TO 0
$(K/S)_{TOTAL}=0$
LOOP EACH DYE
50
ADD PRODUCT OF EFFECTIVE CONCENTRATION AND K/S OF NEXT DYE TO K/S TOTAL.
$(K/S)_{TOTAL}=E_1\cdot(K/S)_1+E_2\cdot(K/S)_2+E_3\cdot(K/S)_3+\ldots+E_N\cdot(K/S)_N$
55
DONE LOOPING DYES ?
NO
YES
60
ADJUST K/S FOR SUBSTRATE DENSITY
$(K/S)_{TOTAL}=\text{DENSITY}\ [E_1\cdot(K/S)_1+E_2\cdot(K/S)_2+E_3\cdot(K/S)_3+\ldots+E_N\cdot(K/S)_N]$
65
INCLUDE EFFECT OF SUBSTRATE COLOR
$(K/S)_{TOTAL}=(K/S)_{SUBSTRATE}+\text{DENSITY}\ [E_1\cdot(K/S)_1+E_2\cdot(K/S)_2+E_3\cdot(K/S)_3+\ldots+E_N\cdot(K/S)_N]$
70
CONVERT K/S VALUE TO RED OR GREEN OR BLUE
$RGB_{TOTAL}=255\left[(1+(K/S)_{TOTAL})-\sqrt{(1+(K/S)_{TOTAL})^2-1}\right]^{1/GAMMA}$
75
DONE LOOPING RGB ?
NO
YES
DONE

FIG. -3C-

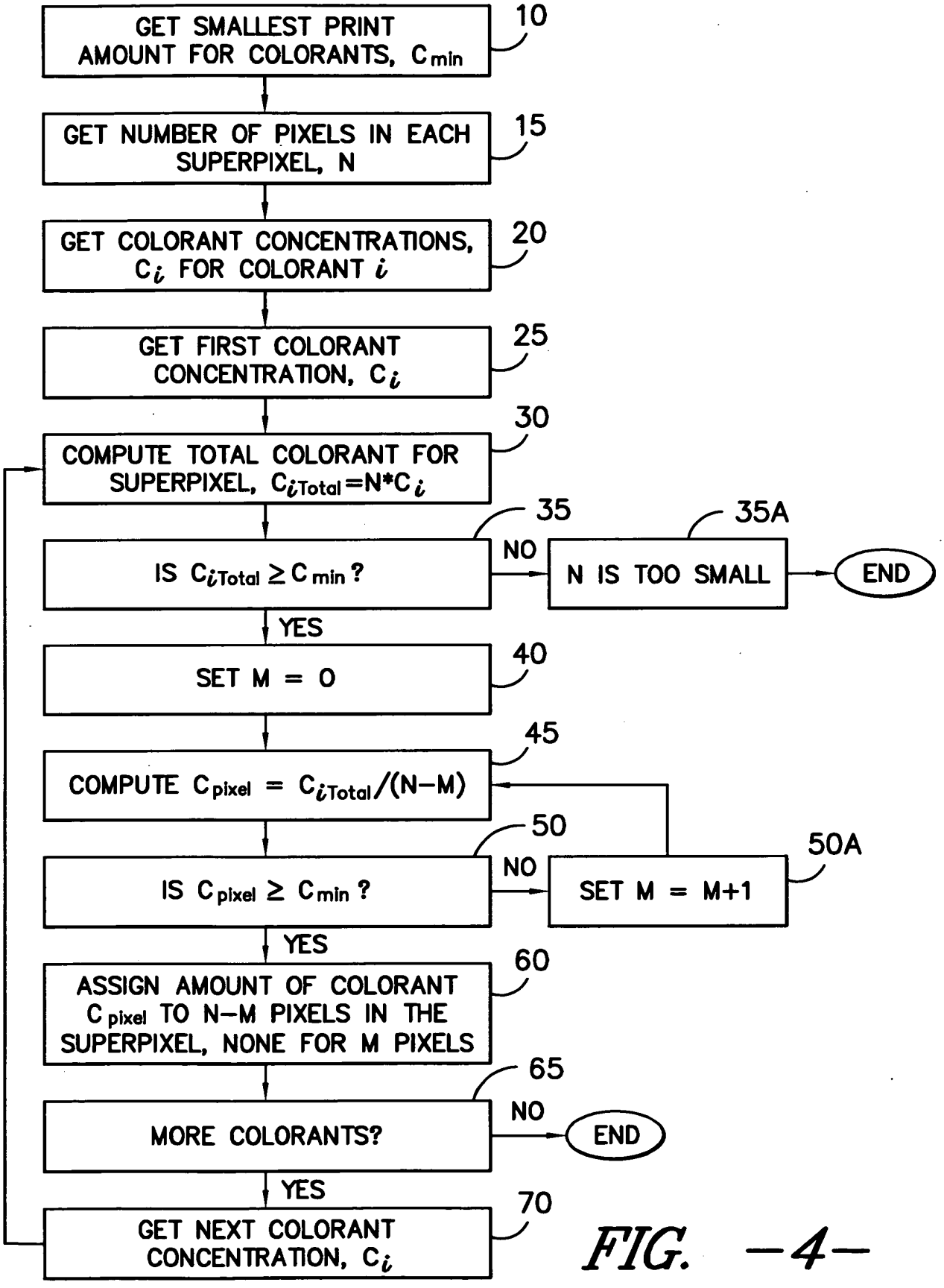

GET SMALLEST PRINT AMOUNT FOR COLORANTS, C_{min}
10
GET NUMBER OF PIXELS IN EACH SUPERPIXEL, N
15
GET COLORANT CONCENTRATIONS, C_i FOR COLORANT i
20
GET FIRST COLORANT CONCENTRATION, C_i
25
COMPUTE TOTAL COLORANT FOR SUPERPIXEL, $C_{iTotal}=N*C_i$
30
IS $C_{iTotal} \geq C_{min}$?
35
NO
N IS TOO SMALL
35A
END
YES
SET M = 0
40
COMPUTE $C_{pixel} = C_{iTotal}/(N-M)$
45
IS $C_{pixel} \geq C_{min}$?
50
NO
SET M = M+1
50A
YES
ASSIGN AMOUNT OF COLORANT C_{pixel} TO N−M PIXELS IN THE SUPERPIXEL, NONE FOR M PIXELS
60
MORE COLORANTS?
65
NO
END
YES
GET NEXT COLORANT CONCENTRATION, C_i
70

FIG. —4—

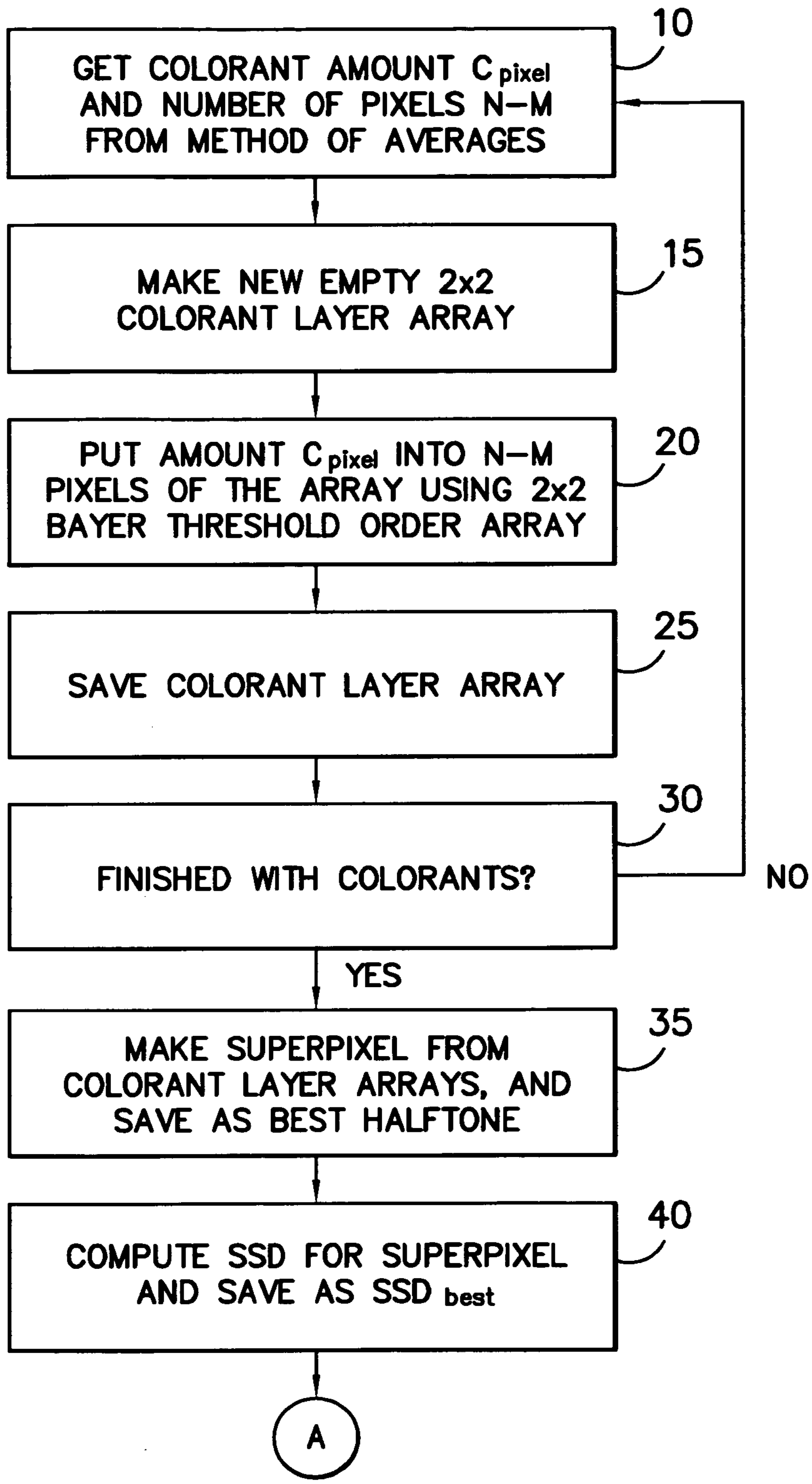


FIG. −5A−

09534729.082201

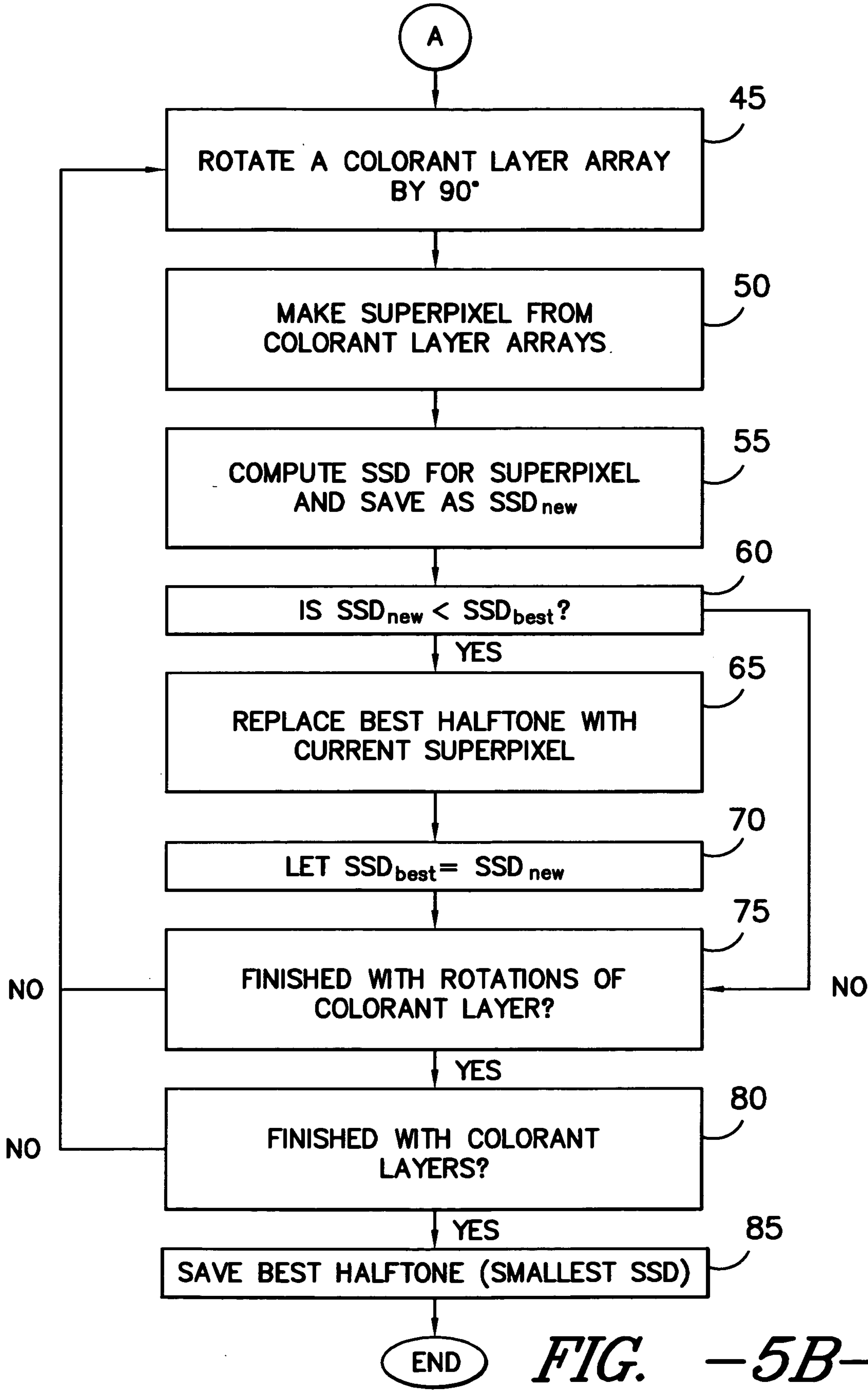

A
ROTATE A COLORANT LAYER ARRAY BY 90°
45
MAKE SUPERPIXEL FROM COLORANT LAYER ARRAYS
50
COMPUTE SSD FOR SUPERPIXEL AND SAVE AS SSDnew
55
IS SSDnew < SSDbest?
60
YES
REPLACE BEST HALFTONE WITH CURRENT SUPERPIXEL
65
LET SSDbest = SSDnew
70
FINISHED WITH ROTATIONS OF COLORANT LAYER?
75
NO
NO
YES
FINISHED WITH COLORANT LAYERS?
80
NO
YES
SAVE BEST HALFTONE (SMALLEST SSD)
85
END

FIG. —5B—

T02280 "62464660

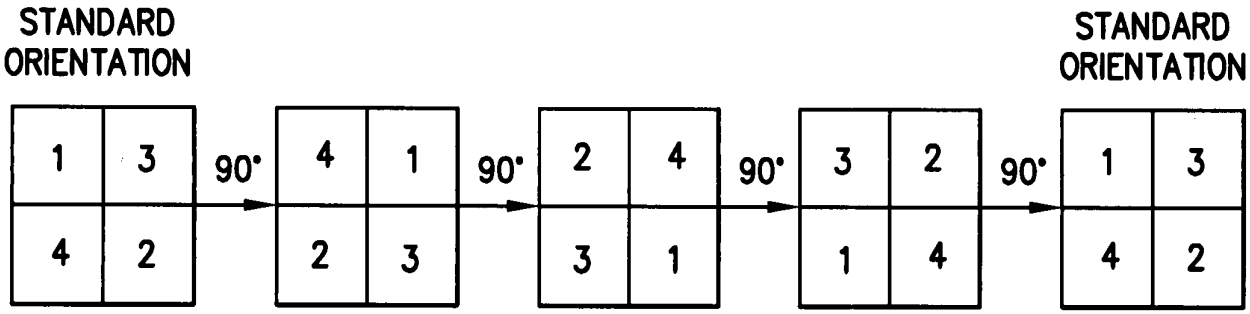


FIG. –6–

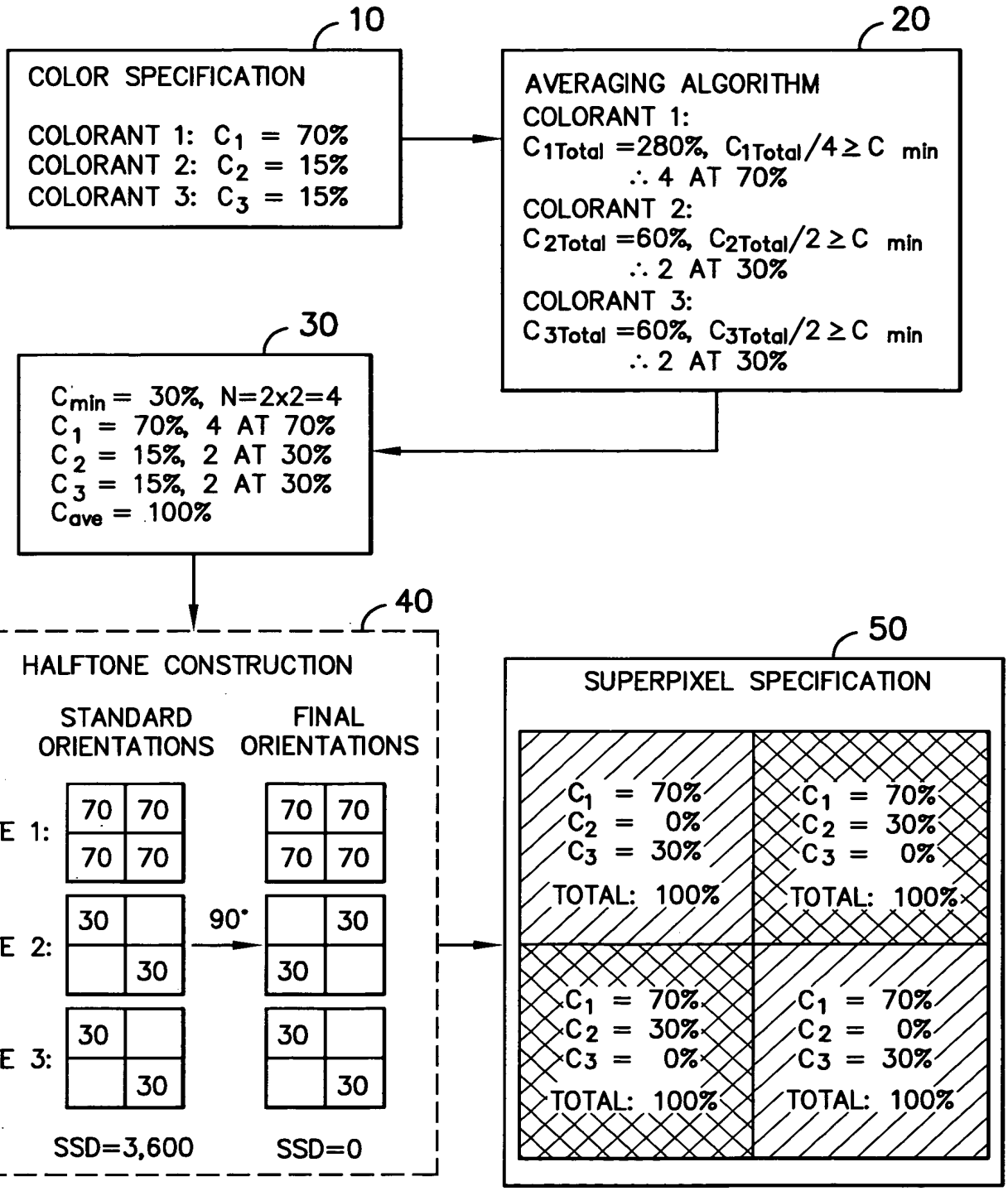

10
COLOR SPECIFICATION
COLORANT 1: C_1 = 70%
COLORANT 2: C_2 = 15%
COLORANT 3: C_3 = 15%
20
AVERAGING ALGORITHM
COLORANT 1:
C_{1Total} =280%, $C_{1Total}/4 \geq C_{min}$
∴ 4 AT 70%
COLORANT 2:
C_{2Total} =60%, $C_{2Total}/2 \geq C_{min}$
∴ 2 AT 30%
COLORANT 3:
C_{3Total} =60%, $C_{3Total}/2 \geq C_{min}$
∴ 2 AT 30%
30
C_{min} = 30%, N=2x2=4
C_1 = 70%, 4 AT 70%
C_2 = 15%, 2 AT 30%
C_3 = 15%, 2 AT 30%
C_{ave} = 100%
40
HALFTONE CONSTRUCTION
STANDARD ORIENTATIONS
FINAL ORIENTATIONS
DYE 1:
DYE 2:
DYE 3:
90°
SSD=3,600
SSD=0
50
SUPERPIXEL SPECIFICATION
C_1 = 70%
C_2 = 0%
C_3 = 30%
TOTAL: 100%
C_1 = 70%
C_2 = 30%
C_3 = 0%
TOTAL: 100%
C_1 = 70%
C_2 = 30%
C_3 = 0%
TOTAL: 100%
C_1 = 70%
C_2 = 0%
C_3 = 30%
TOTAL: 100%

FIG. —7—

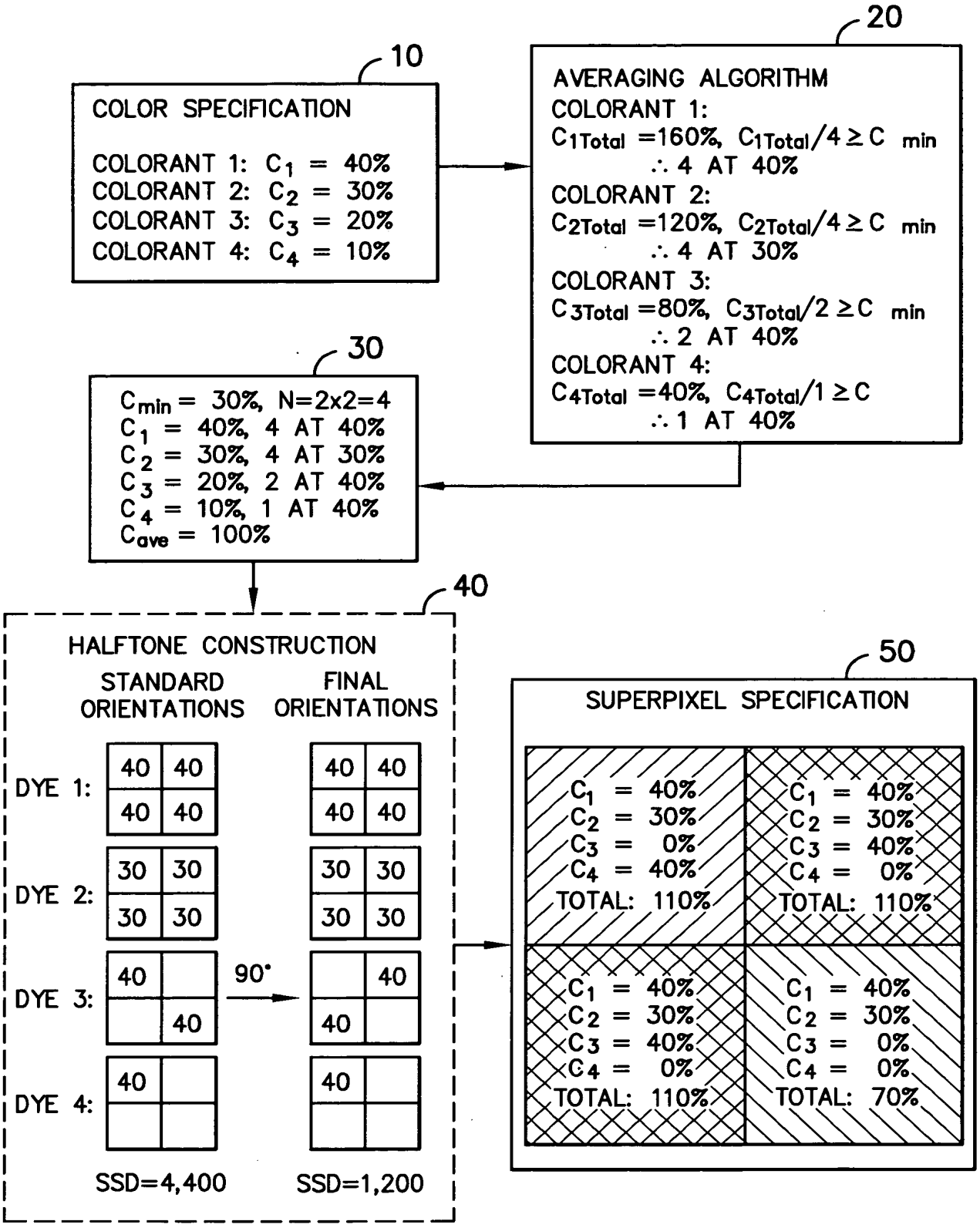

10
COLOR SPECIFICATION
COLORANT 1: C1 = 40%
COLORANT 2: C2 = 30%
COLORANT 3: C3 = 20%
COLORANT 4: C4 = 10%
20
AVERAGING ALGORITHM
COLORANT 1:
C1Total =160%, C1Total/4 ≥ C min
∴ 4 AT 40%
COLORANT 2:
C2Total =120%, C2Total/4 ≥ C min
∴ 4 AT 30%
COLORANT 3:
C3Total =80%, C3Total/2 ≥ C min
∴ 2 AT 40%
COLORANT 4:
C4Total =40%, C4Total/1 ≥ C
∴ 1 AT 40%
30
Cmin = 30%, N=2x2=4
C1 = 40%, 4 AT 40%
C2 = 30%, 4 AT 30%
C3 = 20%, 2 AT 40%
C4 = 10%, 1 AT 40%
Cave = 100%
40
HALFTONE CONSTRUCTION
STANDARD ORIENTATIONS
FINAL ORIENTATIONS
DYE 1:
DYE 2:
DYE 3:
DYE 4:
90°
SSD=4,400
SSD=1,200
50
SUPERPIXEL SPECIFICATION
C1 = 40%
C2 = 30%
C3 = 0%
C4 = 40%
TOTAL: 110%
C1 = 40%
C2 = 30%
C3 = 40%
C4 = 0%
TOTAL: 110%
C1 = 40%
C2 = 30%
C3 = 40%
C4 = 0%
TOTAL: 110%
C1 = 40%
C2 = 30%
C3 = 0%
C4 = 0%
TOTAL: 70%

FIG. —8—

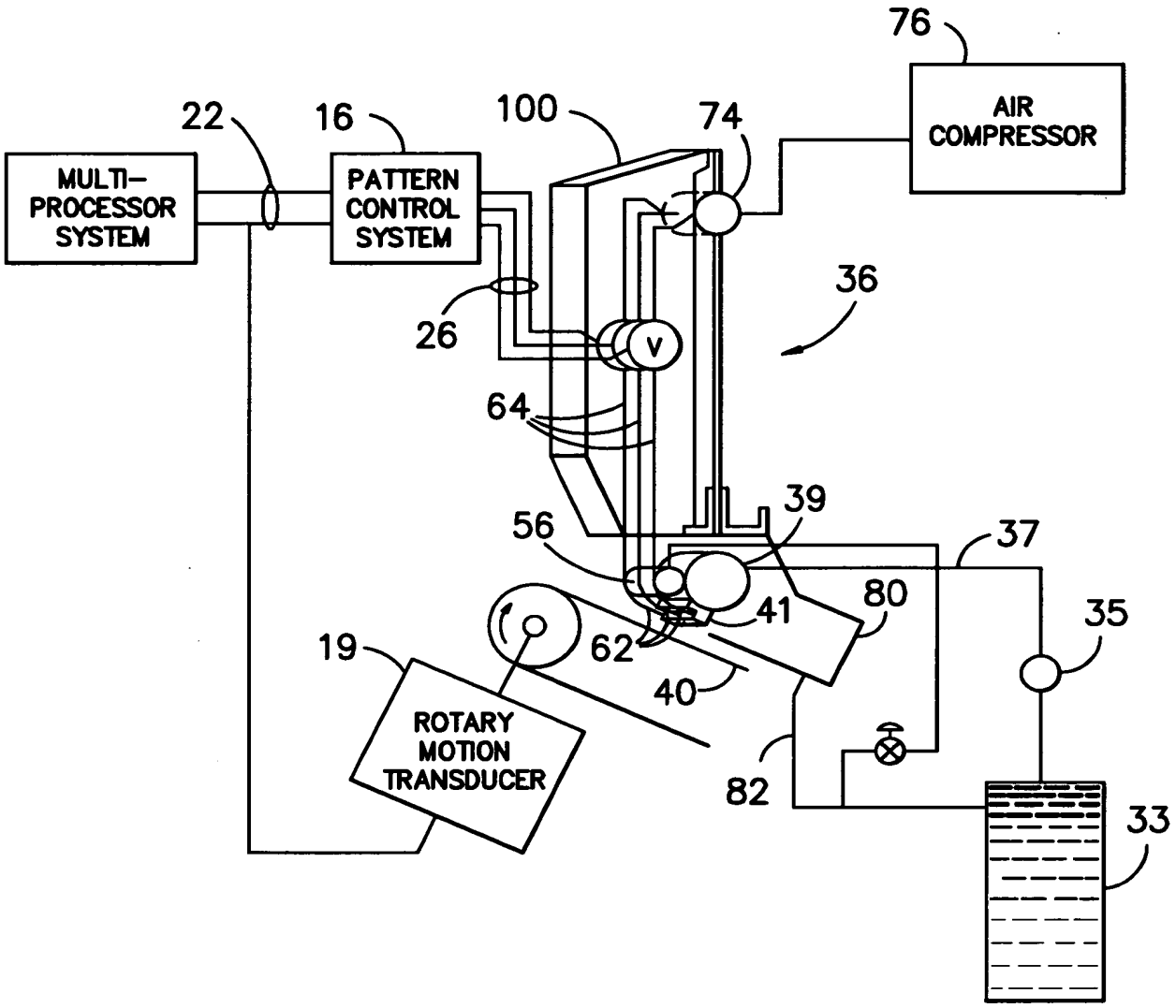
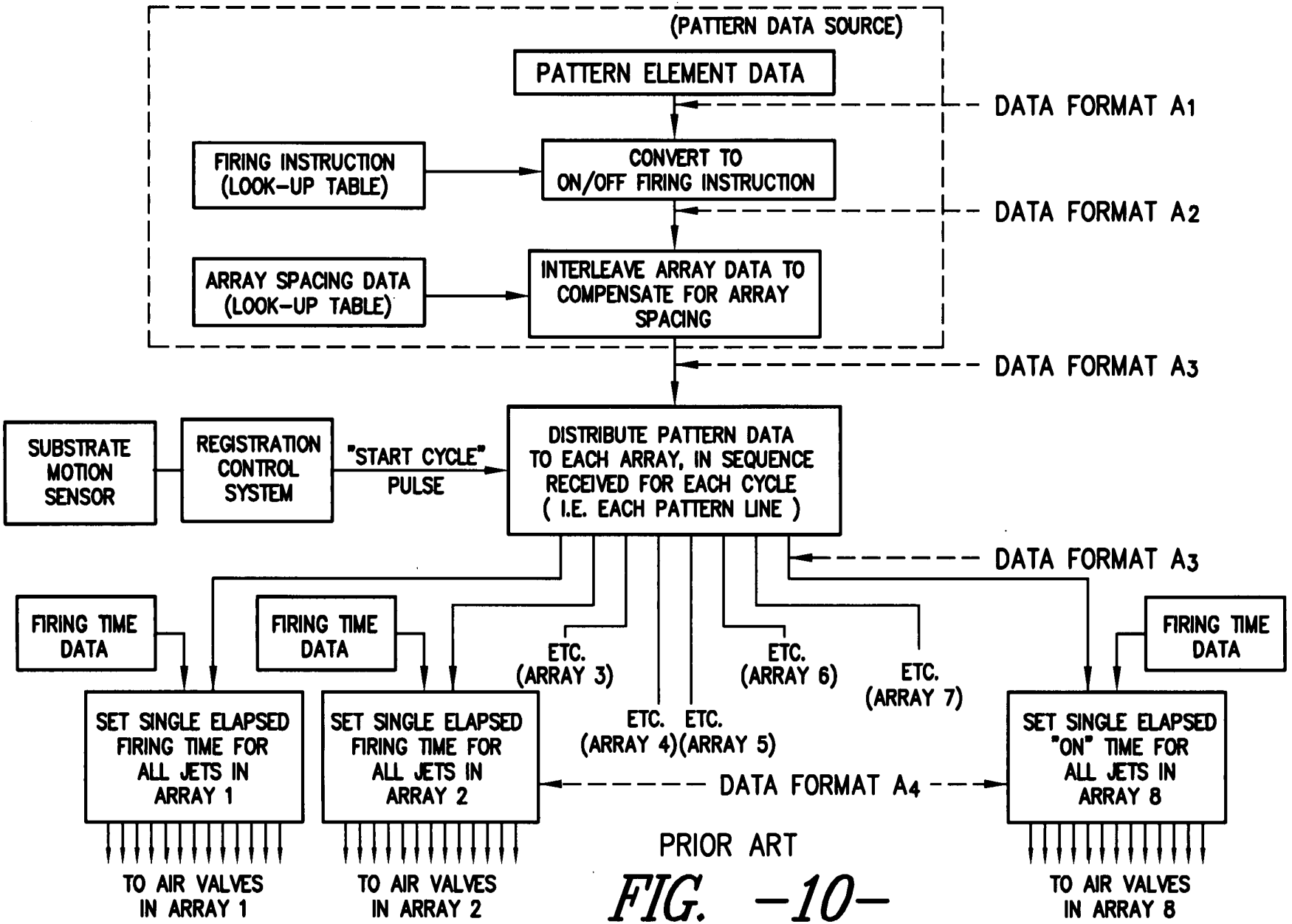

76
AIR COMPRESSOR
22
16
100
74
MULTI-PROCESSOR SYSTEM
PATTERN CONTROL SYSTEM
36
26
V
64
39
56
37
41
80
35
62
19
40
ROTARY MOTION TRANSDUCER
82
33

FIG. —9—

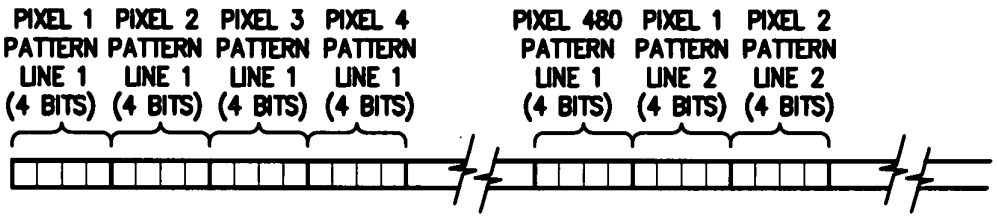
T02280"624E660



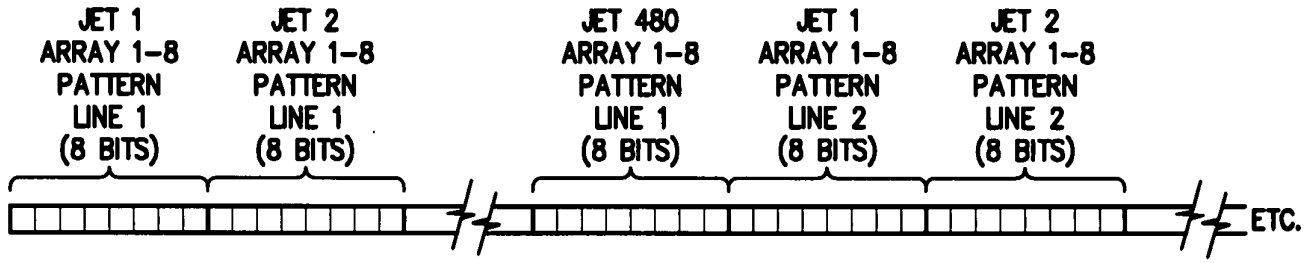
PRIOR ART

FIG. –10–

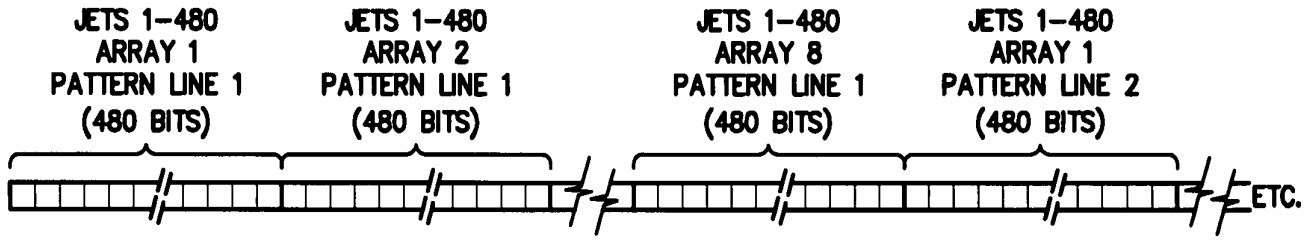
DATA FORMAT A1 :
4 BIT GROUP
DEFINES 1 OF 16 PRE-DEFINED
PATTERN ELEMENTS



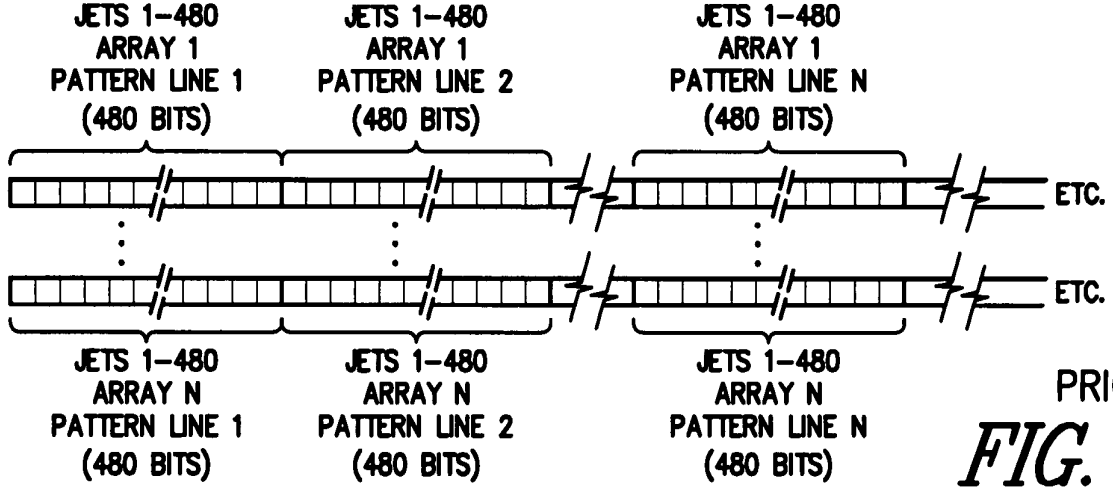
DATA FORMAT A2 :
EACH BIT INDICATES
"FIRE / NO FIRE"
FOR EACH JET ON
EACH ARRAY



DATA FORMAT A3 :
(EACH BIT INDICATES
"FIRE / NO FIRE" FOR EACH JET;
FIRING TIME TO BE PRESET)



DATA FORMAT A4 :
(EACH BIT INDICATES
"FIRE / NO FIRE" FOR EACH JET;
FIRING TIME IS PRESET)



PRIOR ART

FIG. —11—

T02280"624E660

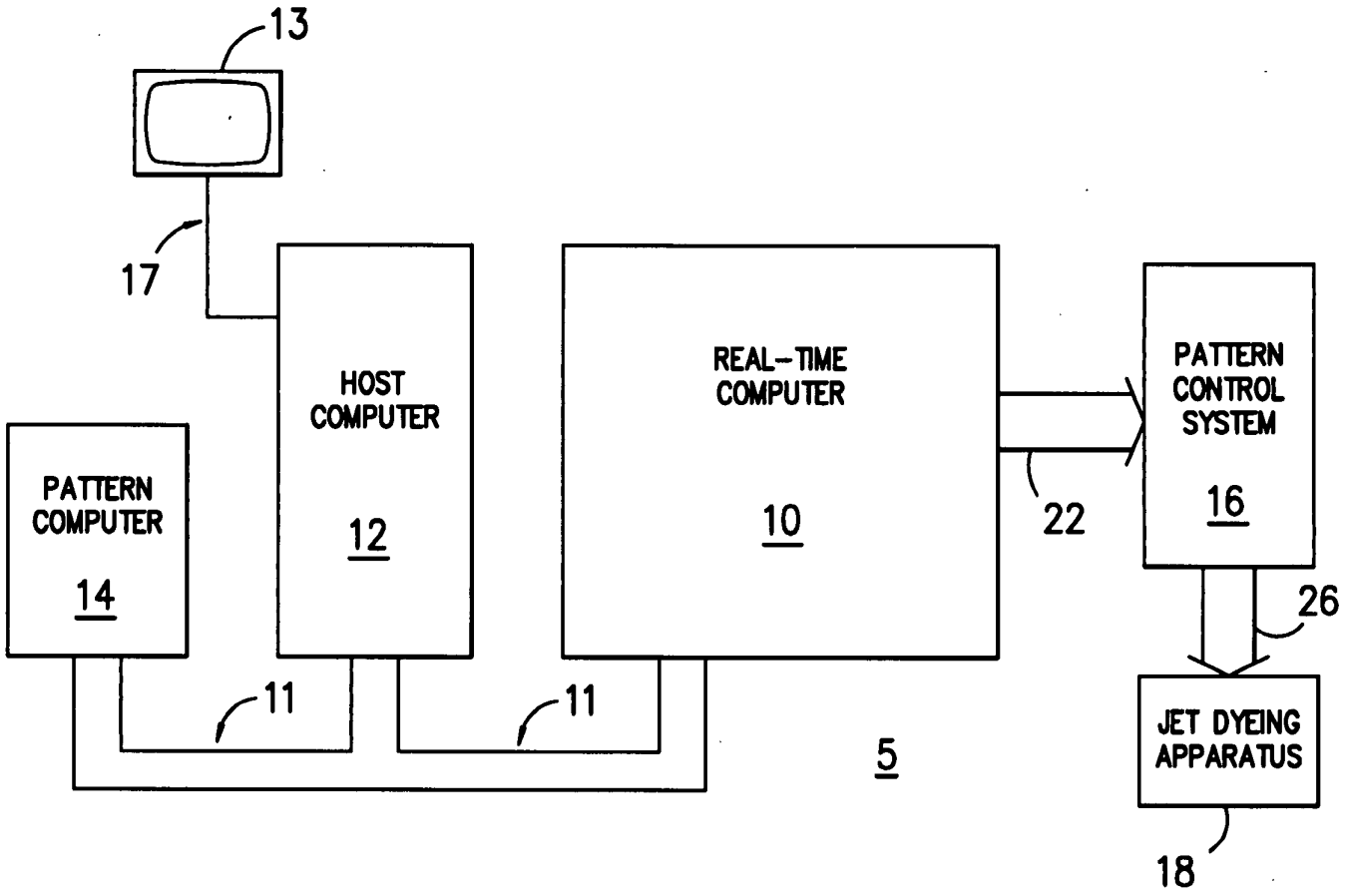


FIG. -12-

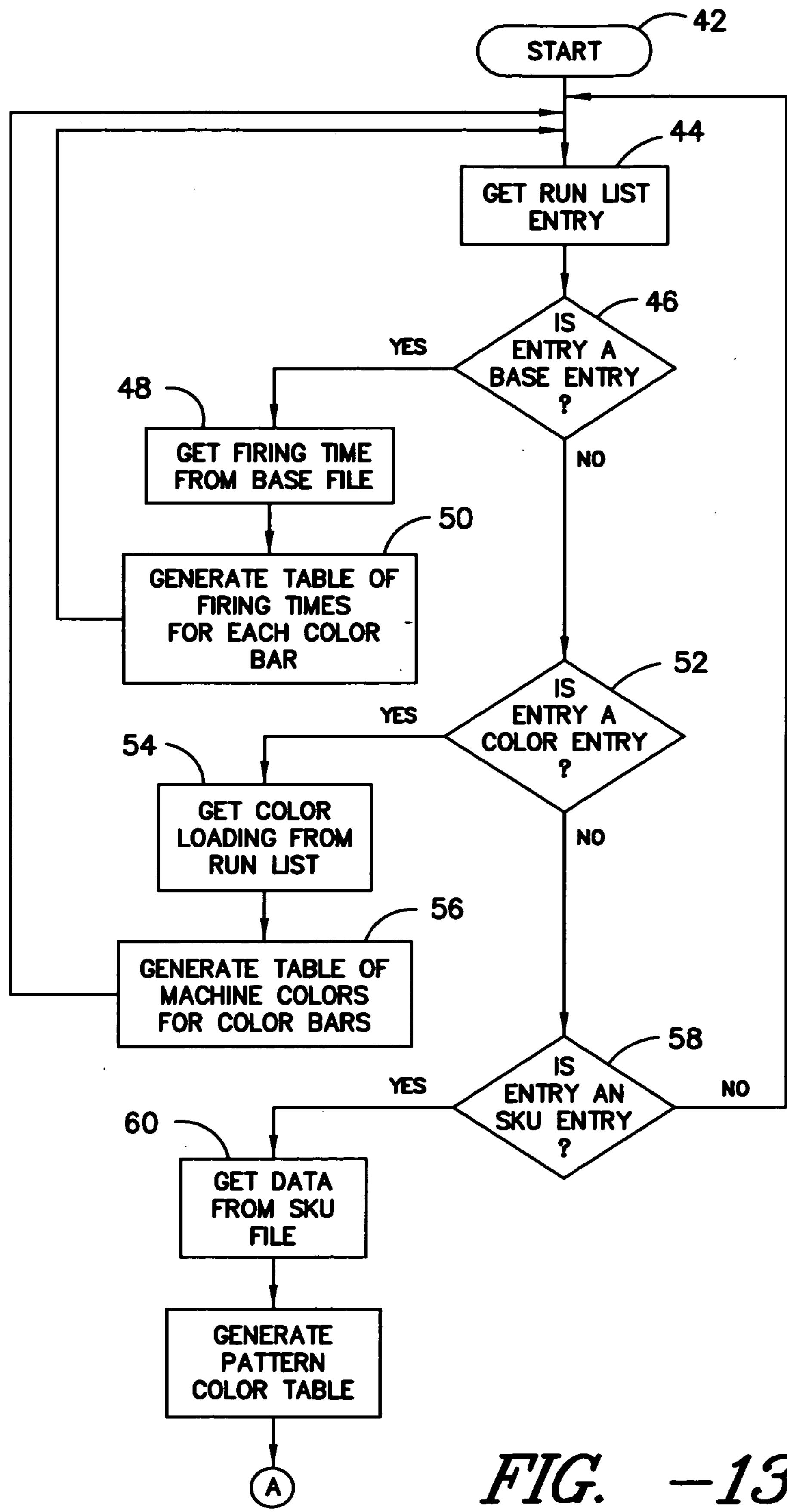

42
START
44
GET RUN LIST ENTRY
46
IS ENTRY A BASE ENTRY ?
YES
NO
48
GET FIRING TIME FROM BASE FILE
50
GENERATE TABLE OF FIRING TIMES FOR EACH COLOR BAR
52
IS ENTRY A COLOR ENTRY ?
YES
NO
54
GET COLOR LOADING FROM RUN LIST
56
GENERATE TABLE OF MACHINE COLORS FOR COLOR BARS
58
IS ENTRY AN SKU ENTRY ?
YES
NO
60
GET DATA FROM SKU FILE
GENERATE PATTERN COLOR TABLE
A

FIG. —13—

EP 0 802 509 A2

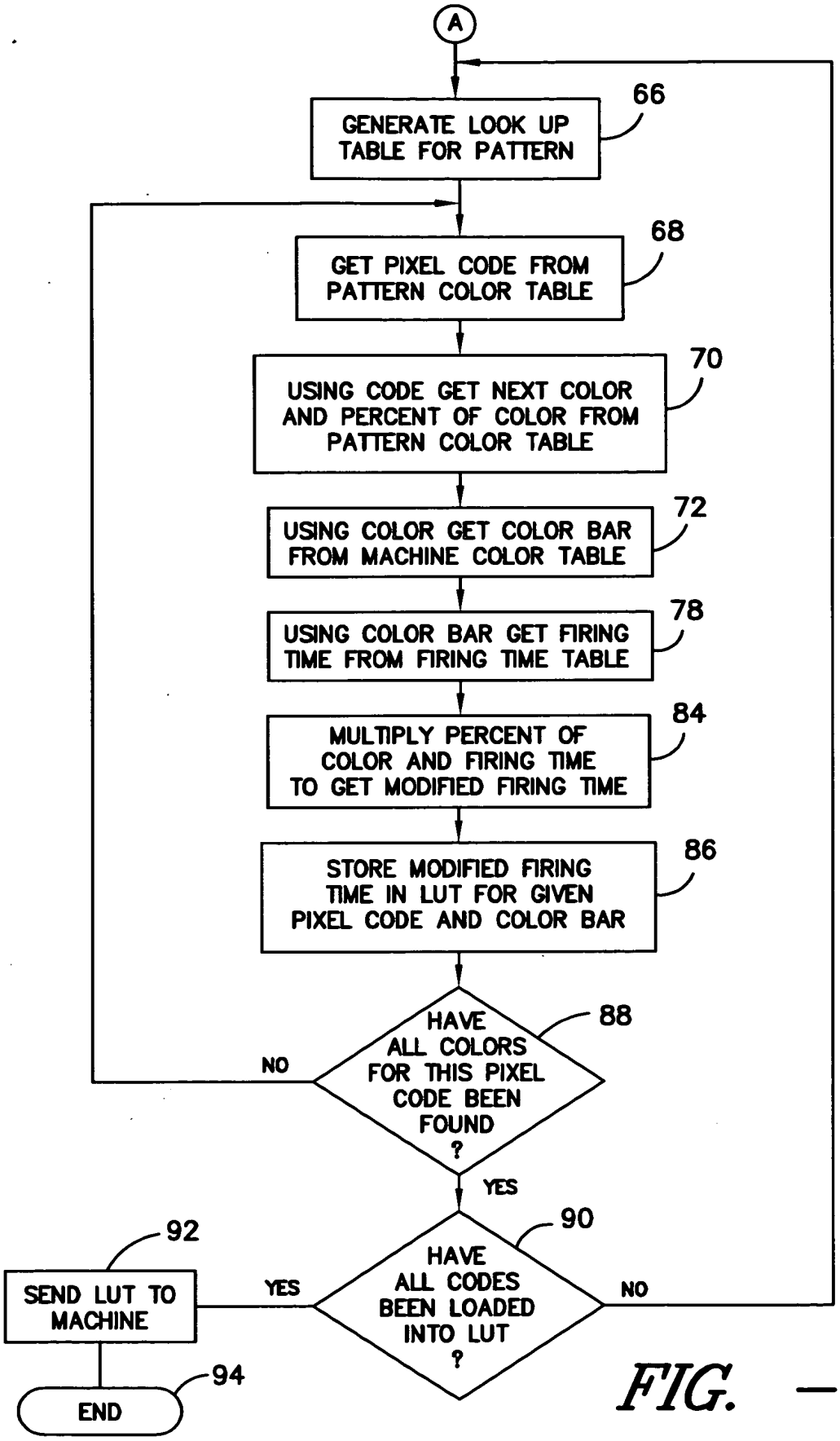


FIG. -14-

T02280 "624E660

BASE WXYZ

BAR	FT
1	10
2	10
3	20
4	15

FIG. –15A–

MACHINE CONFIG.

COLOR	BAR
RED	1
BLUE	2
GREEN	3
YELLOW	4

FIG. –15B–

SKU ABC

CODE	COLOR
A	RED
B	BLUE

FIG. –15C–

BASE WXYZ

BAR	FT
1	10
2	10
3	20
4	15

FIG. –16A–

MACHINE CONFIG.

COLOR	BAR
RED	1
BLUE	2
GREEN	3
YELLOW	4

FIG. –16B–

SKU ADE

CODE	COLOR
A	50% RED, 50% BLUE
C	GREEN

FIG. –16C–

LUT'S

CODES	1	2	3	4
A	10MS	0	0	0
B	0	10MS	0	0

FIG. –15D–

LUT'S

	1	2	3	4
A	5MS	5MS	0	0
C	0	0	20MS	0

FIG. –16D–

LUT'S

	1	2	3	4
A	0	0	20MS	0
B	0	10MS	0	0
C	5MS	2.5MS	0	3.75MS

FIG. –16E–

LUT'S

	1	2	3	4	5
A	0	0	0	0	10MS
B	0	10MS	0	0	0

FIG. –16F–

T02280"624E660

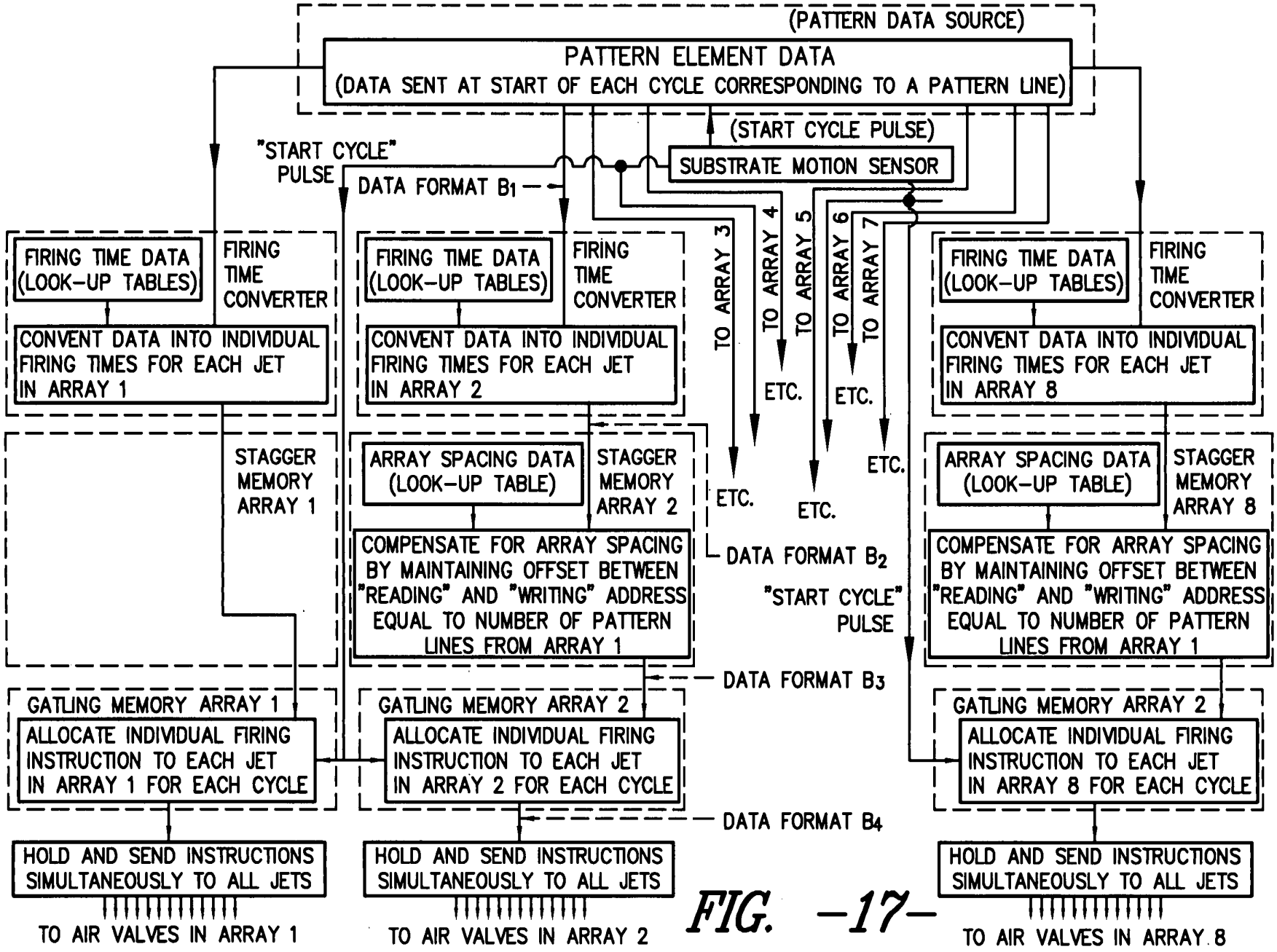
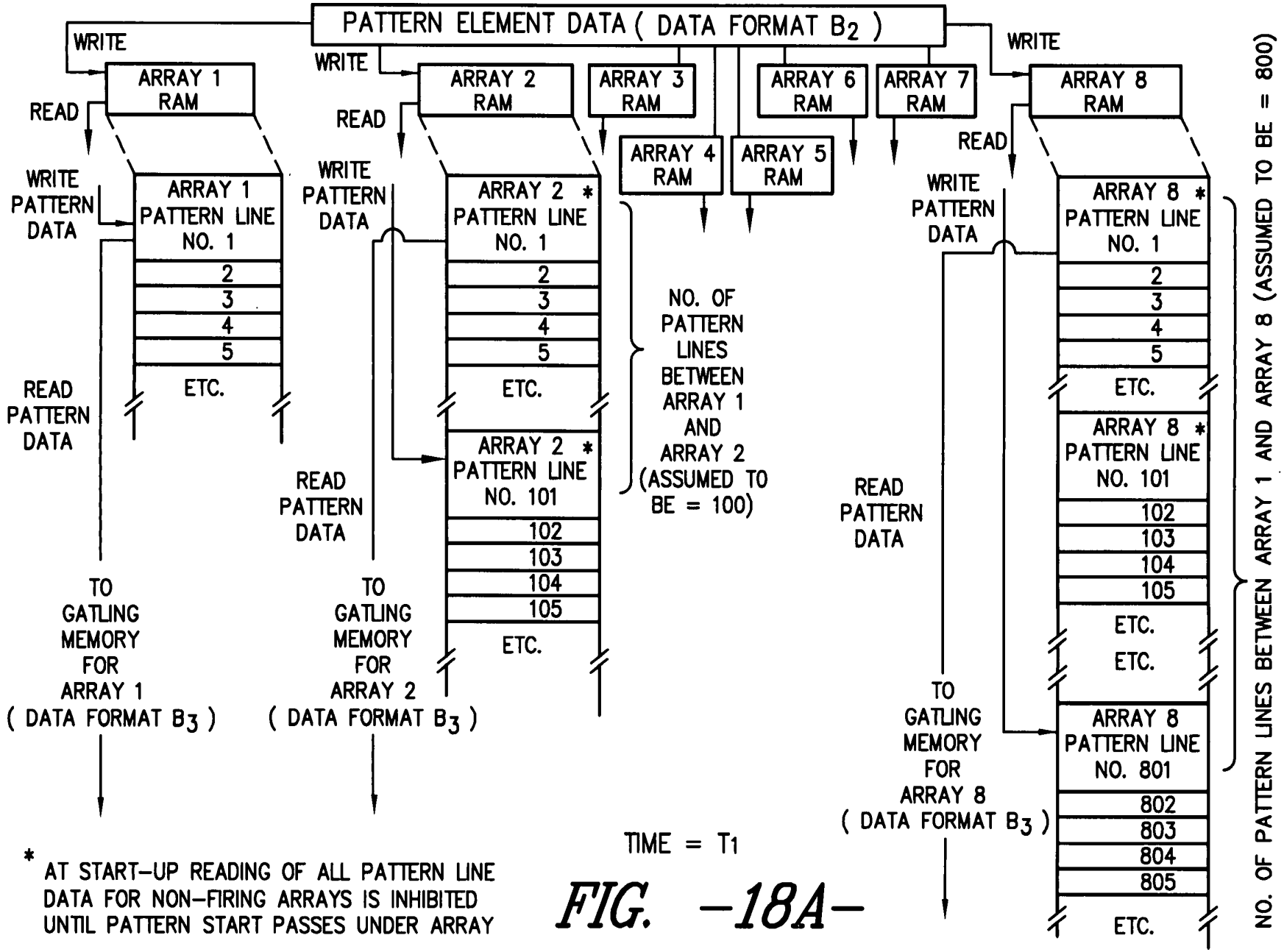


FIG. -17-

T02280"624E660



* AT START-UP READING OF ALL PATTERN LINE DATA FOR NON-FIRING ARRAYS IS INHIBITED UNTIL PATTERN START PASSES UNDER ARRAY

FIG. -18A-

T02280"6274E660

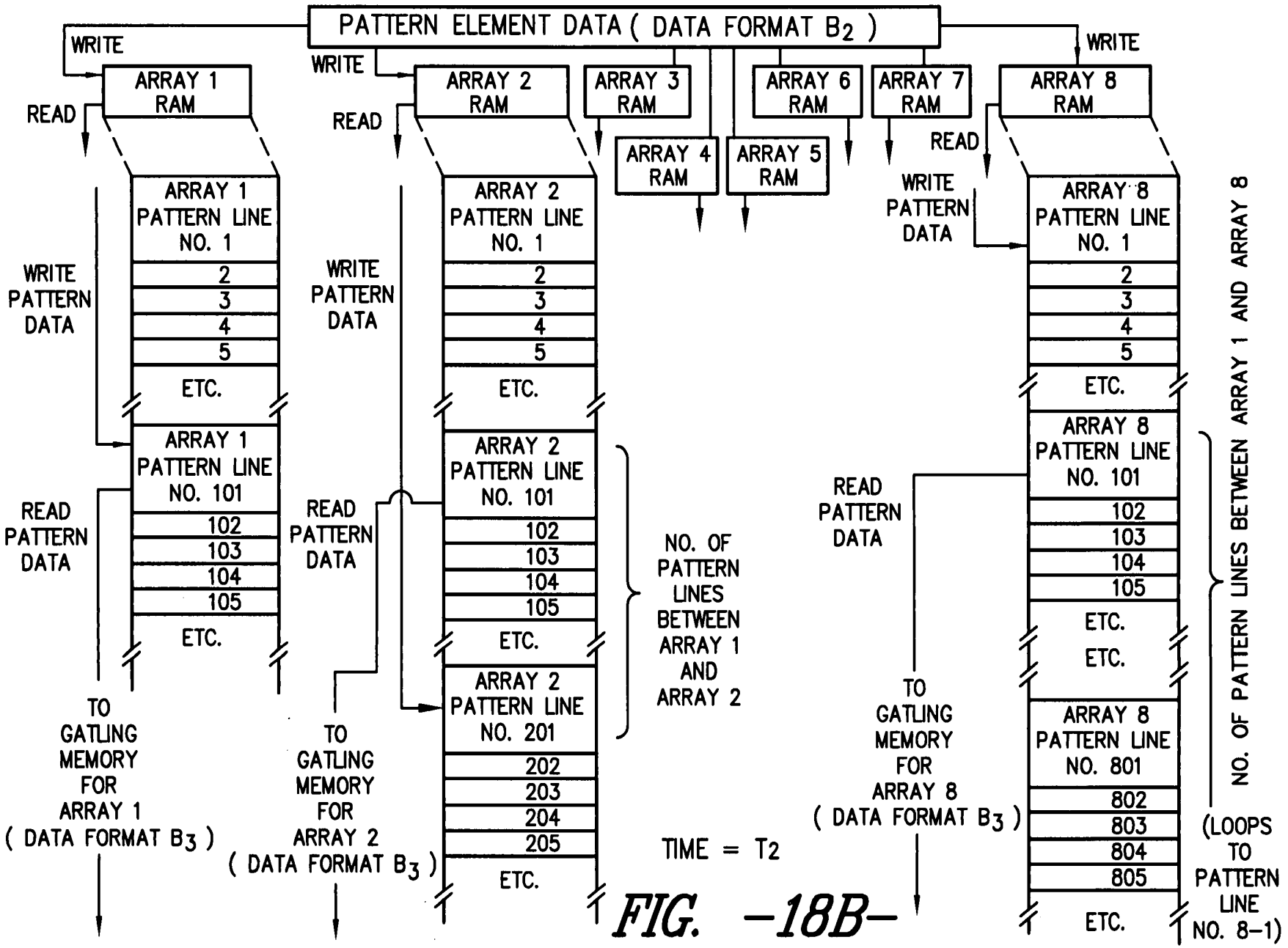


FIG. -18B-

T02280"624hE660

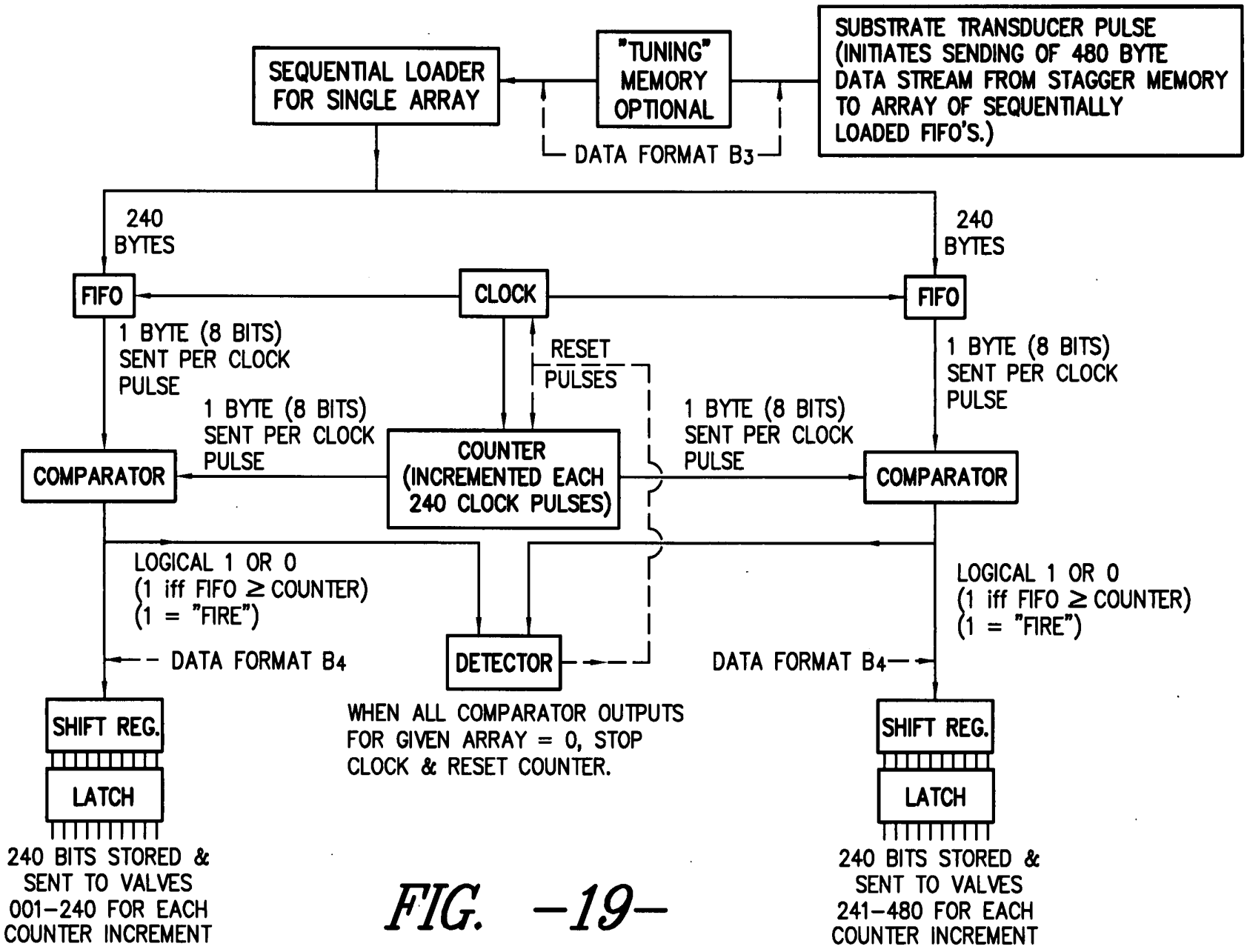
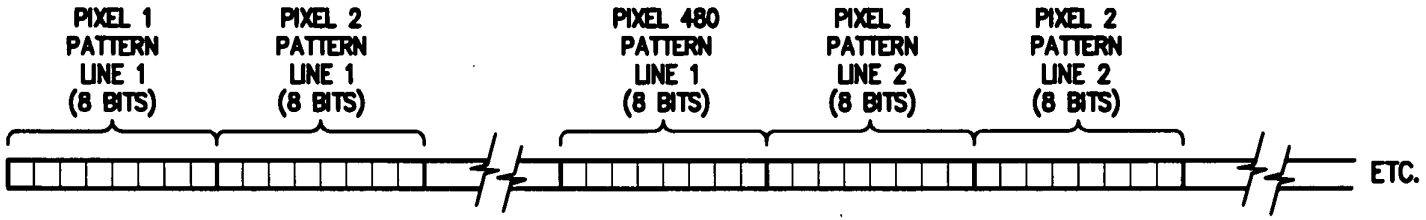


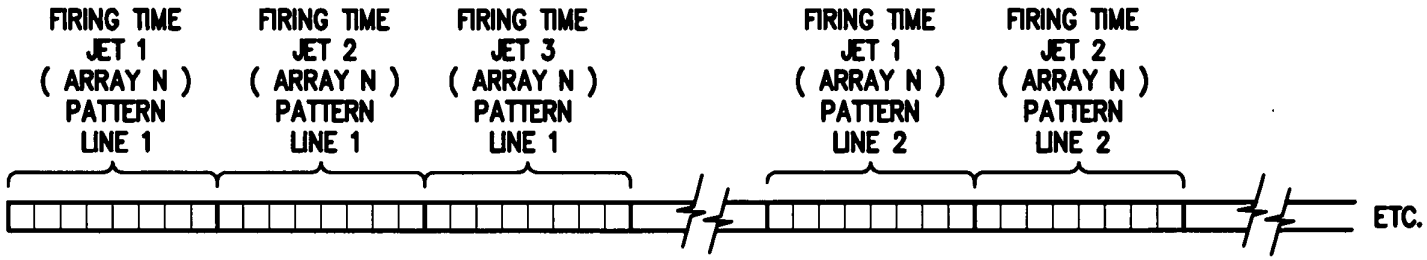
FIG. –19–

T02280"624E660

DATA FORMAT B_1 :
(OUTPUT FROM PATTERN DATA SOURCE)
8 BIT GROUP DEFINES 1 OF 256 PRE-DEFINED PATTERN ELEMENTS



DATA FORMAT B_2 :
(OUTPUT FROM PATTERN DATA SOURCE)
EACH 8 BIT GROUP DEFINES 1 OF 256 POSSIBLE FIRING TIMES



DATA FORMAT B_3 :
(OUTPUT FROM STAGGER MEMORY)
DATA HAS BEEN RESEQUENCED/DELAYED TO ACCOMODATE INTER-ARRAY SPACING

DATA FORMAT SAME AS B_2

DATA FORMAT B_4 :
(OUTPUT FROM PATTERN DATA SOURCE)
EACH BIT INDICATES "FIRE / NO FIRE" COMMAND FOR GIVEN ARRAY

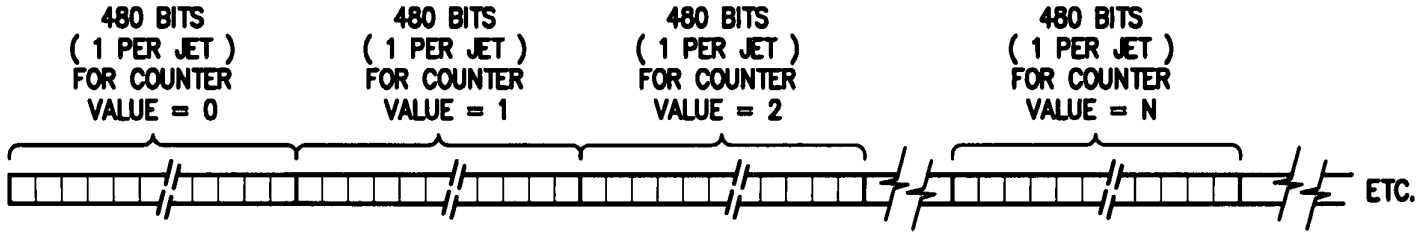


FIG. -20-

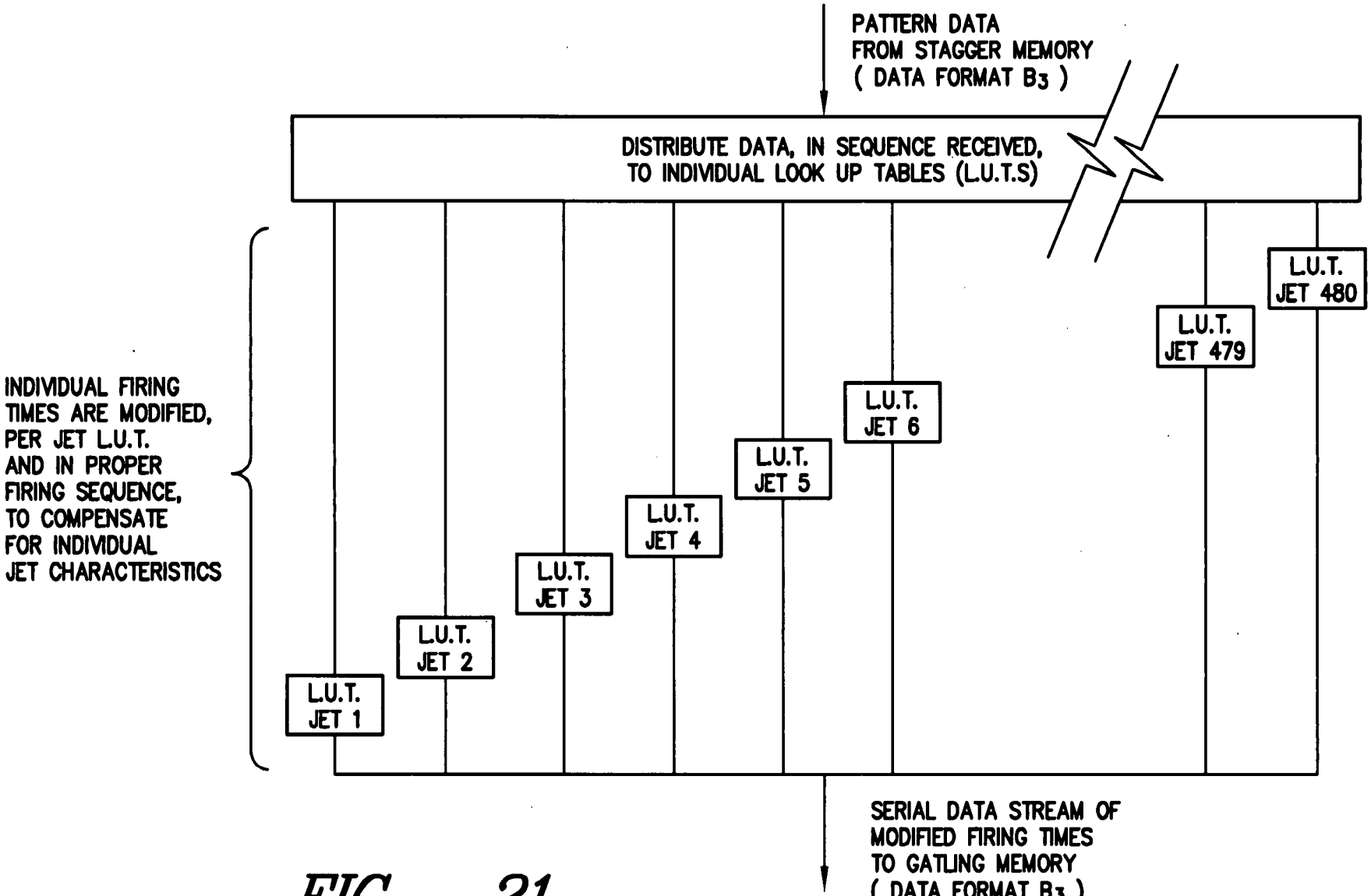

PATTERN DATA
FROM STAGGER MEMORY
(DATA FORMAT B3)
DISTRIBUTE DATA, IN SEQUENCE RECEIVED,
TO INDIVIDUAL LOOK UP TABLES (L.U.T.S)
INDIVIDUAL FIRING
TIMES ARE MODIFIED,
PER JET L.U.T.
AND IN PROPER
FIRING SEQUENCE,
TO COMPENSATE
FOR INDIVIDUAL
JET CHARACTERISTICS
L.U.T.
JET 1
L.U.T.
JET 2
L.U.T.
JET 3
L.U.T.
JET 4
L.U.T.
JET 5
L.U.T.
JET 6
L.U.T.
JET 479
L.U.T.
JET 480
SERIAL DATA STREAM OF
MODIFIED FIRING TIMES
TO GATLING MEMORY
(DATA FORMAT B3)

FIG. –21–